24. The method of forming a honeycomb sandwich composite panel according to Claim 20, wherein:

said curing temperature of said sealing material is about 120 ± 5°C, and said specified curing time period is about 130 ± 10 minutes.

Regarding claim amendments, Applicants have attached to this amendment a document entitled "Version with Markings to Show Changes Made".

REMARKS

Entry of this Amendment and favorable reconsideration of this application, as presently amended, is respectfully requested.

In this Amendment, Claim 2 has been amended to more particularly point out and distinctly claim applicants' contribution to the art. No new matter or new issues are believed to be present in this amendment. Claims 1, 3-6 and 11-13 have been canceled. Thus, Claims 2, 10 and 16-24 are pending in this application.

In view of the cancellation of a number of claims, the issues raised in the Official Action of May 24, 2002 will be discussed with reference to the remaining claims.

Claims 2 and 10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Cundiff* and *Lubin*, further in view of *Fellman, et al.* (U.S. 4,968,545), *Ahrens* (U.S. 4,323,623), *Browne* (U.S. 4,861,649), all of record, and further in view of EP 588,437 or French patent 2,772,037.

Applicants respectfully traverse these rejections and request reconsideration for reasons discussed herein.

Applicants' invention is related to a honeycomb sandwich composite panel made by using an RTM (Resin Transfer Molding) process. In previously known methods of forming honeycomb sandwich panels, disclosed in the specification at page 1, line 24, to page 2, line 7, in order to keep an impregnated resin from flowing into a honeycomb core, a prepreg material is used as a raw material. However, the use of the prepreg material requires high material cost and expensive facilities for the storage of materials and for a curing operation, in particular, it would create a problem of cost reduction of composite materials.

Applicants have discovered a method of forming a honeycomb sandwich composite panel without using the prepreg material. Applicants' invention, recited in Claims 2 and 10, forms the panel by providing a thermosetting sealing film material containing glass microspheres between a dry fabric and both sides of the honeycomb core. The use of the thermosetting sealing material with glass microspheres (microbaloons) controls viscosity of the resin film and has adhesive property for joining the honeycomb core to the dry fabric and with a sufficient sealing effect. Specific structures are shown in the specification at page 7, lines 3-25 and Figures 3 to 6.

The claims recite "essentially consisting of" as the transitional phrase to thereby exclude the prepreg material which is an essential part of the *Cundiff* invention.

In contrast to Applicants' invention, *Cundiff* discloses the honeycomb sandwich composite panel by using an RTM (Resin Transfer Molding) process with the honeycomb core, adhesive film and prepreg material and dry fabric.

Accordingly, *Cundiff* discloses, as an essential component, the prepreg material as a composite of the honeycomb sandwich composite, and hence there is difference between Applicants' invention and *Cundiff* at the point of the presence of the prepreg material. As discussed above, Applicants' invention uses the resin film including glass microspheres (microbaloons) to adjust the viscosity of the resin film and having an adhesive property for joining the honeycomb core to the dry fabric and a sufficient sealing effect to prevent the resin from flowing into the honeycomb core during resin impregnation. This feature is not suggested or taught by *Cundiff*. Nothing in *Cundiff* would motivate a person skilled in the art to omit the prepreg component.

Regarding *Lubin*, as the Examiner indicated, the "Handbook of Composites" discloses that a material which cures during bonding is a thermosetting material. Accordingly, *Lubin* only discloses that a curable material is in fact thermosetting, there is no teaching or suggestion about the use of the thermosetting sealing material including glass microspheres as sealing material. Furthermore, there is no teaching or suggestion of using the thermosetting sealing material including glass microspheres instead of the prepreg material.

Accordingly, even if the teachings of *Cundiff* are modified in view of *Lubin*, the invention recited in Claims 2 and 10 would not be obtained.

For these reasons, Applicants believe that Claims 2 and 10 are patentable over the references and respectfully request reconsideration of this application.

The Examiner indicated, based on *Fellman, et al.*, *Ahrens, et al.*, and *Browne*, that the use of syntactic foam which included resin and glass microspheres instead of the resin film and/or prepreg material would have been obvious.

However, Applicants respectfully state that *Fellman, et al.*, *Ahrens, et al.*, and *Browne* disclose the laminated structure of the prepreg and the syntactic foam. Accordingly, the prepreg material is used as one of composite materials for forming the product. Hence, there is no suggestion or teaching of forming the honeycomb sandwich composite panel without the prepreg material.

Thus, even if the combination of *Cundiff* and *Lubin* is modified in view of *Fellman, Ahrens* and *Browne*, the invention recited in Claims 2 and 10 would not be obtained.

It is clear that *Cundiff* fails to suggest that the prepreg layer can be omitted. The Official Action attempts to show that *Fellman* suggests that a glass microsphere containing layer would have suggested itself as a replacement for the prepreg layer. Yet, *Fellman* clearly teaches not to eliminate the prepreg layer. In col. 2, line 60 *et seq. Fellman* teaches to use both the prepreg layer and the layer containing microspheres.

Browne also teaches the presence of both the prepreg layer 3 and the syntactic form layer 5; see Figure 1.

Ahrens also shows both types of layers present.

Thus, it is manifest that the secondary references fail completely to support the position taken in the Official Action. They do not, in fact, teach that the resin-glass microsphere layer is a

replacement for the prepreg layer. Hence motivation for replacing the prepreg layer is entirely lacking in these three secondary references.

With respect to the newly-cited EP and French patent documents, they, too, do not suggest eliminating the prepreg layer in the construction of *Cundiff*.

Notwithstanding the detailed Official Action and numerous references, the fact remains that the prior art fails to suggest omitting the prepreg and forming Applicants' product.

For this reason, Applicants believe that Claims 2 and 10 are patentable over the references and respectfully request the reconsideration of this application.

New Claims 16-24 are submitted to be patentable for the same reasons as set forth above.

The advantages obtained by the present invention are as follows: As the method of forming a honeycomb sandwich composite panel comprises a step of stacking a thermosetting sealing material (not the prepreg material) on at least one side of a honeycomb core, low-cost honeycomb sandwich components can be produced. In addition, as the thermosetting sealing material is a resin film including glass microspheres to adjust viscosity of said resin film, the resin is prevented from flowing into the honeycomb core during the impregnating step.

Applicants submit that none of the references disclose the advantageous features set forth in the claims. *Cundiff, et al.* teaches a process for forming a honeycomb sandwich composite panel comprising the steps of stacking dry fabric 18a, 18b on both sides of a honeycomb core 12 with adhesive films 14a and 14b as well as prepreg material 16a and 16b therebetween, heating the assembly at the curing temperature of the adhesive films 14a and 14b as well as the prepreg material 16a and 16b to cause the films to harden, impregnating the dry fabric with a

thermosetting resin, and curing the resin of the resin impregnated dry fabric by hot pressing the entire assembly. However, *Cundiff* fails to suggest that the prepreg can be omitted during the stacking step.

The definition of the term "prepreg" is very clear, for example as shown in the attached pages (from the document "Airframe Structural Design" by Michael Chun-Yung Niu). That is, "prepreg" means a combination of mat, fabric, nonwoven material, or roving with resin, which clearly excludes the materials that are used in the present invention.

Although some prior art says that various materials can be used instead of the prepreg material, those references never suggest that the resin can be prevented from flowing into the honeycomb core during the impregnating step by means of only using a material other than the prepreg material.

In view of the cancellation of claims, the rejection of claims under 35 U.S.C. § 112 is rendered moot.

In view of above, Applicants request that the rejection be withdrawn and the claims be allowed at the Examiner's earliest convenience.

Respectfully submitted,

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Version with Markings to Show Changes Made

Amendments in the Claims

In accordance with 37 C.F.R. § 1.121(c) the following version of the claims as rewritten by the foregoing amendment shows all the changes made relative to the previous version of the claims.

Claim 2 is amended as follows:

2. (Twice Amended) A method of forming a honeycomb sandwich composite panel consisting essentially of [the steps of]:

stacking a thermosetting sealing material on at least one side of a honeycomb core, said thermosetting sealing material having an adhesive property and being resin film including glass microspheres;

stacking a dry fabric on [both sides of a honeycomb core with a] said thermosetting sealing material [having an adhesive property placed in between];

hardening said sealing material by heating said sealing material and said dry fabric to the curing temperature of said sealing material and maintaining this temperature for a specified curing time period of [time] said sealing material;

impregnating said dry fabric with a thermosetting resin while varying the temperature of said sealing material and said dry fabric to a resin impregnating temperature and maintaining this temperature for a specified period of time; and

hardening the resin impregnated into said dry fabric by heating said sealing material and said dry fabric to the curing temperature of said thermosetting resin and hot-pressing them for a specified period of time[,

said sealing material being a resin film including glass microspheres to adjust viscosity of said resin film having in addition to said adhesive property a sufficient sealing effect to prevent said thermosetting resin from flowing into said honeycomb during said impregnating step].

Claims 1, 3-6 and 11-13 are cancelled.

New Claims 19-24 are added.

AIRFRAME STRUCTURAL DESIGN

Practical Design Information and Data on Aircraft Structures

By

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CONMILIT PRESS LTD.

[redacted]

of advanced composite material with extensive use of bonding in assembly. This material and assembly is completely different from the typical semi-monocoque aluminum airframe.

Glossary

Advanced Composites Advanced composites are defined as composite materials applicable to aerospace construction and made by imbedding high-strength, high-modulus fibers within an essentially homogeneous matrix.

Advanced Filaments Continuous filaments made from high-strength, high-modulus materials for use as a constituent of advanced composites.

Angleply Same as *crossply*.

Anisotropic Not isotropic; having mechanical and/or physical properties which vary with direction relative to natural reference axes inherent in the material.

Autoclave A closed vessel for producing an environment of fluid pressure, with or without heat, to an enclosed object while under-going a chemical reaction or other operation.

B-Stage An intermediate stage in the reaction of a thermosetting resin in which the material softens when heated and swells in contact with certain solvents but does not entirely fuse or dissolve. Materials are usually precured to this stage to facilitate handling and processing prior to final cure.

Balanced Laminate A composite laminate in which all laminae at angles other than 0° and 90° occur only in ± pairs (not necessarily adjacent).

Composite Material Composites are considered to be combinations of materials differing in composition or form on a macroscale. The constituents retain their identities in the composite; that is, they do not dissolve or otherwise merge completely into each other although they act in concert. Normally, the components can be physically identified and exhibit an interface between one another.

Constituent In general, an element of a larger grouping. In advanced composites, the principal constituents are the fibers and the matrix. Glass scrim cloth, where used, is also considered to be a constituent, although of secondary importance.

Crossply Any filamentary laminate which is not uniaxial. Same as *angleply*. (In some references, the term crossply is used to designate only those laminates in which the laminae are at right angles to one another.)

Cure To change the properties of a thermosetting resin irreversibly by chemical reaction, i.e., condensation, ring closure, or addition. Cure may be accomplished by the application of suitable [illegible]

longitudinal axis of the fiber with respect to a stated reference axis.

Filament A variety of fibers characterized by extreme length, such that there are normally no filament ends within a part except at geometric discontinuities. Filaments are used in filamentary composites and are also used in filament winding processes, which require long continuous strands.

Filamentary Composites A major form of advanced composites in which the fiber constituent consists of continuous filaments. Filamentary composites are defined here as composite materials composed of laminae in which the continuous filaments are in nonwoven, parallel, uniaxial arrays. Individual uniaxial laminae are combined into specifically oriented multiaxial laminates for application to specific envelopes of strength and stiffness requirements.

Filament Winding An automated process in which continuous filament (or tape) is treated with resin and wound on a removable mandrel in a pattern.

Filament Wound Pertaining to an object created by the filament winding method of fabrication.

Fill Yarn oriented at right angles to the warp in a woven fabric.

Glass In composite materials, all reference to glass will refer to the fibrous form of glass as used in filaments, woven fabric, yarns, mats, and chopped fibers.

Hybrid A composite laminate comprised of laminae of two or more composite material systems.

Interlaminar Shear Shearing force tending to produce a relative displacement between two laminae in a laminate along the plane of their interface.

Isotropic Having uniform properties in all directions. The measured properties of an isotropic material are independent of the axis of testing.

Lamina A single ply or layer in a laminate made of a series of layers.

Laminate A product made by bonding together two or more layers or laminae of material or materials.

Laminate Orientation The configuration of a crossplied composite laminate with regard to the angles of crossplying, the number of laminae at each angle, the exact sequence of the lamina layup.

Matrix The essentially homogeneous material in which the fibers or filaments of a composite are imbedded.

Orthotropic Having three mutually perpendicular planes of elastic symmetry.

Prepreg, Preimpregnated A combination of mat, fabric, nonwoven material, or roving with resin, usually advanced to the B-stage, ready for curing.